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FLORIDA'S EXCLUSIVE CITRUS MAGAZINE

The Present Status of Scale Insects Infesting Citrus

— W. L. THOMPSON

A Review of Our Knowledge of Melanose and Its Control

— R. S. EDSALL

June 1941

Vol. 22 — No. 6

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A Review Of Our Knowledge Of Melanose... and Its Control

By R. S. EDSALL
AT MEETING OF FLORIDA STATE HORTICULTURAL SOCIETY

The Casual Organism And Its Effect Upon The Host

Melanose was first observed by Swingle and Webber (4) in November, 1892, at Citra, Fla., but was not described by them until 1896. This disease is caused by a fungus which has two stages, a pycnidial stage, **Phomopsis citri** (2), and an ascigerous stage, **Diaporthe citri** (3). The first stage produces the water-borne pycnispore on the dead wood throughout the trees. This is the principle casual organism. The second stage produces the air-borne ascospore on dead wood underneath the trees. Although this latter spore is capable of producing infection it is not considered of much economic importance.

The pycnidia of the casual organism are difficult to detect in nature without the aid of a good hand lens. They occur sometimes in the dead bark of the large limbs or even trunks but are found most abundantly on small twigs and fruit stems of the preceding year's crop. Spore production is more abundant in tissue that has recently died than in those parts which have been dead for a year or more. The fungus has never been known to produce spores in the melanose lesions produced on living parts of the tree.

Under average conditions infection is effected 36 to 48 hours after the spores come into contact with the young leaves or fruit. The germ tube penetrates the cuticle and passes downward between the lateral walls of adjacent epidermal cells. It then branches and extends intercellularly between the palisade parenchyma. There is no evidence of the infection visible to the unaided eye until the fourth day after inoculation. By this time the fungus has attacked the cell membranes resulting in their degeneration and the formation of a gummous substance in the cells and intercellular spaces. The disssolution and collapse of the cells is followed by the formation of a depression which marks the site of the lesion. By the time the lesions are 7 days old a corky layer has been formed between the normal and invaded tissue. This corky layer continues to grow until the tiers of cork are 7 to 12 cell layers in thickness. At the same time the normal growth of the healthy tissues beneath the lesions results in everting the corky layer and thus in raising the lesions above the surface. Coincident with the development of the corky layer, the tensions on the cuticle cause its rupture and the gum mass, on exposure to the air, becomes brown and dry.

Dissemination

The general structure of the fruiting body and the periods of normal spore discharge, also the localization of the disease with respect to the areas of infection, indicate that the casual organism is disseminated principally by rain, fog or heavy dews.

Repeated efforts have been made to trap pycnispores in Petri dishes (7) from air currents during both fair and inclement weather. The traps were placed at regular stations in old seedling plantings where there was an abundance of melanose. In no case were viable **Phomopsis** spores trapped. At a later date Ruehle and Kuntz (9) demonstrated that the ascospores of the perfect stage are forcibly ejected into the air from the fruiting bodies and are probably carried considerable distances by air currents.

The question has frequently arisen as to whether prunings left on the ground underneath the trees are a source of melanose infection. A study was made (7) wherein prunings of dead or weakened twigs and limbs were left under trees throughout the season of infection. Although melanose fungus developed abundantly on these prunings, no appreciable increase in melanose was observed on these trees in excess of what developed on pruned trees from which the prunings were hauled away. Even those tender parts within a foot or less above piles of prunings failed to develop melanose in greater quantity than similarly situated parts on check trees. This test was conducted over a period of three years.

The removal of prunings from a grove is another added cost to an already expensive operation. As a general practice I believe that we are justified in removing only those prunings which are large enough to interfere with other cultural practices. However, the piling of prunings around the trunks of the trees is not considered a desirable practice for their presence may promote the development of certain crown diseases.

Contributing Factors

The melanose fungus sporulates principally in dead twigs and fruit stems. Dead wood may be the result of one of many factors. Among the important ones are infestations of scale insects, shading effects in the interior of the tree, trunk and root diseases, frosts or freezes, storms and droughts, nutritional deficiencies and other conditions which tend to lower the vitality of the trees.

Under average conditions it is believed that scale insects are usually responsible for the death of more twigs than all other agencies combined. When the infestation is heavy, even for a short time, large amounts of the bearing wood are killed. These insects, even when present in almost unnoticeable numbers are responsible for the death of many twigs and small branches.

The length of time the parts have been dead with respect to the time when melanose outbreaks occur is of considerable importance. Parts that have died within two or three months are much more likely to harbor the casual organism than parts that have been dead for many months. Those parts which are killed in winter or spring are excellent breeding places for the melanose fungus and to a large extent are the source of infection which is of greatest economic importance.

Fawcett (5) studied the temperature relation of the fungus itself when grown on certain media. He found that an increase in temperature has a marked effect on an increased rate of mycelial growth up to between 75° and 81° F. which seemed close to the optimum temperature. However, temperatures above this retarded growth, markedly, no growth taking place above about 95° F.

Winston (7) and his associates studied the effect of temperature on the time required for infection and the severity of the infection. This

study showed that infection can take place in 12 hours at temperatures ranging from 59° to 86° F. The greatest degree of infection seemed to occur between 68° and 77° F. Temperatures above and below 68° F. seemed to prolong the incubation period and have a marked influence upon the degree of the resulting infection.

Unfortunately, the temperature conditions in Florida are sufficiently favorable for the development of the fungus, at nearly all times, that we can expect infection periods whenever there is enough moisture. The presence of sufficient moisture for sporulation and the subsequent dissemination of these spores, at a time when plant parts are susceptible, is the primary factor in determining the extent of the melanose infection.

Economic Importance

Melanose is by far the biggest single grade lowering factor with which we must contend. A survey made by Mr. Victor Bowman (1) shows that on an average of all varieties of oranges, melanose was a 12% greater grade lowering factor than any other cause, with wind chafing second. On grapefruit melanose was a 25% greater grade lowering factor, with rust mite second. It is particularly noticeable, in this study, that seedling oranges and grapefruit seem to be more seriously affected by melanose than other varieties. However, it is generally conceded that the age and condition of the trees has more effect of the severity of the infection than the variety. In summing up the grade lowering factors we find that in oranges 58% and in grapefruit 73% can, to a large extent, be controlled by a well planned spray and fertilizer program.

In addition to the actual grade lowering caused by melanose it has been estimated (7) that stem-end rot, caused by the melanose fungus is responsible for fully 40% of the decay of Florida oranges and grapefruit in transit, on the market, or in the consumer's home. There is also another important stem-end rot of Florida citrus fruits which is caused by the fungus **Diplodia natalensis.** I do not have any data available on the subject but I think it is quite probable that the melanose fungus is also partially responsible for considerable early dropping of mature fruit.

In tables 1 and 2 I have listed the New York averages on Indian River oranges and grapefruit shipped under four or five leading brands for the past five seasons. You will notice that there is a difference in the sal price per box of 1s and 2s varying from 26c to 65c on oranges and from 38c to 76c on grapefruit. This difference is sufficient in most cases to pay the entire cost of production.

Methods of Control

Pruning

Extensive pruning experiments for melanose control have been conducted (8) and it has been shown that melanose can be controlled or materially reduced by thoroughly pruning out all dead wood. This fact has also been demonstrated in commercial practice by a number of growers almost every year. However, in a great number of cases this method has not given satisfactory control. This is particularly true in old bearing groves.

In view of the fact that it is necessary to remove all the small dead twigs, in order to get reasonably good melanose control, the cost of the operation frequently becomes prohibitive and impractical. In young trees and blocks which have been severely damaged by cold, pruning for melanose control has been very effective.

As a general practice, in blocks that are subject to severe melanose, it is considered more economical to

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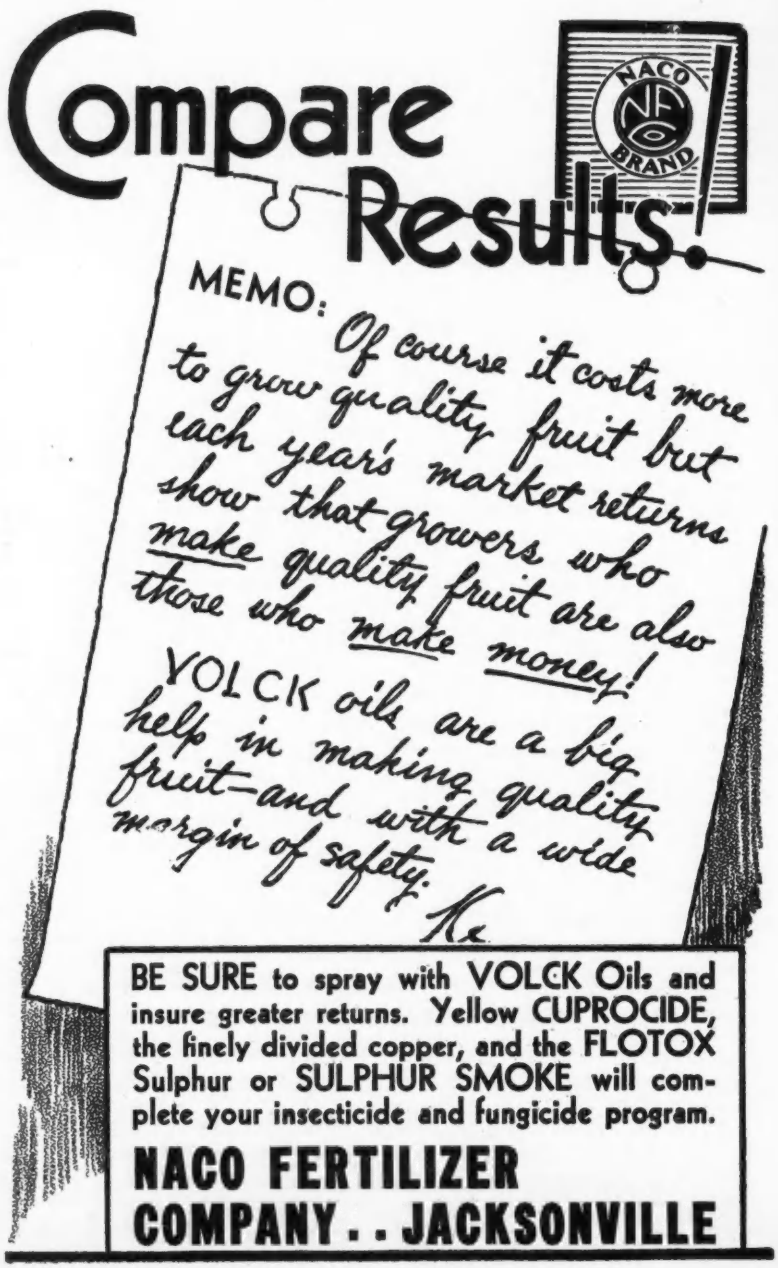
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The Present Status Of Scale Insects Infesting Citrus...

By W. L. THOMPSON
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At State Horticultural Society Meeting

Progress in one field of work usually affects either directly or indirectly other associated fields so the progress made by horticulturists with citrus nutritional problems in improving the general condition of the trees has affected the problem of scale control. Dr. L. O. Howard has aptly described a condition similar to that of the average citrus grove in this state in his book "The Insect Menace" in which he states, "Humanity has created conditions peculiarly favorable to certain kinds of insects and they are multiplying as they never would have done had not man given them a chance, and, by providing them with enormous quantities of food and placing it before them in the most inviting way fairly begged them to do their worst and to exercise to the utmost those extraordinary powers of multiplication . . . " The more recent practice of supplying secondary elements, which include copper, zinc, manganese, and magnesium, in addition to nitrogen, phosphorus, and potassium has so improved the vigor of the trees that the foliage is both plentiful and more suitable for the development of scales.

The question arises as to why the scales have become more abundant on vigorously growing citrus trees than on trees in poor condition. It is a common opinion that vigorous trees are more resistant to insect infestations than less vigorous ones, but that theory does not hold true with the sucking insects that attack citrus trees. Scales and whiteflies are more abundant on vigorously growing citrus trees than on "hard" or less vigorous trees, and it is for this reason that scale control will probably be more of a problem in the future than in the past. The severity of infestations will of course vary from year to year because of seasonal conditions and other undetermined factors. The year of 1940 was apparently very favorable for the development of scale insects as well as whiteflies and mites. The reasons for the abnormal increases cannot be definitely stated except, as stated by the speaker in a previous article (1), the cold weather of January, 1940, and the dry weather during almost the entire year in certain sections of the state were factors in upsetting the natural balance of control. The deposit of residue on the leaves from nutritional sprays was held responsible by some, but the residue was only a contributing factor. In unsprayed check plots scale increases were more pronounced than they have been during any other year since the work was begun. Abnormal scale increases also developed in commercial groves that had received no inert residue sprays. The fact should not be overlooked that where nutritional sprays were applied as well as other essential nutrients, the spring growth was more healthy and more suitable for scale development than the growth on trees deficient in some of the nutrients. There is no doubt that residue on the leaves is a contributing factor in causing scale buildup, but the results of recent studies indicate that where the change in cultural practices has resulted in a more vigorously growing tree throughout the year, the increasing abundance of scales is more a result of improved tree condition than of any other single factor. General tree vigor or an abundance of green foliage has been a forerunner of purple scale increases. Following the freeze of December, 1934, the trees responded with a flush of growth on inside and outside limbs. Because of the relatively weak condition of the trees a light crop of fruit was set in 1935 so there was no particular crop strain and the foliage, especially the inside foliage, remained green throughout that year and the first half of 1936. In the summer and fall of 1936 there was a noticeable increase of scales in many groves because of the relative abundance of green foliage. Following the freeze of January, 1940, there was a decided increase of scales during the current year. The fundamental difference in tree condition in the two periods was the relatively weak condition of the trees following the freeze of 1934 as compared to the more vigorous condition of the trees at the time of and following the freeze of January, 1940. The only data available to show the tree

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Practical Applications Of Plant Growth-Substances ....In Horticulture

By FRANK E. GARDNER
Bureau of Plant Industry, U. S. D. A.
At Meeting Florida State Horticultural Society

The numerous fundamental researches with the plant hormone-like chemicals and the varied responses they bring about in plant parts are pointing the way to the discovery of increasing numbers of practical applications of these compounds in the solution of horticultural problems. In discussing some of these horticultural applications and in pointing out future possibilities for the plant growth-substances perhaps the most logical approach to the subject is to consider the different observed responses of plant tissues when these laboratory-made chemicals are applied. In so extensive a field of endeavor it will not be possible in this brief report to enter into detailed review nor, unfortunately, to cite all of the researches pertinent to the subject.

In writing of this group of chemicals investigators have groped around in a generally unsatisfactory attempt to find a name with which to refer to them and which is descriptive of their action. In this report the terms "hormones" and "growth-substances" are used synonymously. In the literature the latter term is perhaps most commonly used probably because the most frequently observed response is a stimulation of growth. This growth, however, instead of being general in character, is usually restricted to a particular part or organ of the plant and indeed even to particular groups of cells within that organ or part. Sometimes this stimulated growth is orderly in character, resulting in seemingly normal tissue differentiation and the development of more or less normal organs such as roots and fruits. Sometimes, however, the growth is in the wildest disorder with certain cells dividing at top speed resulting in twisted, disarranged organs and in grotesque proliferations and galls (1).

Stimulation of growth, however, is not the only result which can be obtained from the so-called "growth-substances." In fact, under certain conditions growth inhibition results and, as will be pointed out later, this observation has also been made use of in horticultural practices. Whether the use of growth-substances will result in stimulation or inhibition, in orderly or disorderly development, or indeed in any observable effect whatever depends on a great many factors such as the particular compound used, the concentration applied, the manner of its application, the part or organ of the plant receiving the application and its condition at the time with respect to sensitivity to stimulus.

With this brief and necessarily inadequate introduction there follows a discussion of some of the specific observable effect of growth-substances on plant tissues and the horticultural applications developed therefrom.

Root Initiation

Some 60 years ago the botanist, Julius Sachs, postulated that a specific root forming substance is manufactured in the leaves of plants and moves basipetally to lower portions to cause root development. It remained, however, for modern plant physiologists and chemists to demonstrate the correctness of Sach's hormone theory by extracting root stimulating substances from plants, determining their chemical structure and then synthesizing in the laboratory these compounds and hosts of others which, although not known to occur in plants, have hormone-like activity. Today the practical usage of compounds such as indole buytric and naphthalene acetic acids, usually in proprietary preparations, for stimulating the initiation of roots on cuttings is widely established.

In general it may be said that a relatively high concentration of growth-substance and a prolonged exposure to its action is necessary for the stimulation of root initiation. To accomplish this cuttings are usually treated by soaking their basal portions for periods of 6 to 24 hours or more in a water solution of the growth-substance, or by dipping the bases of the cuttings in a talc powder containing the growth-substance which will remain in contact with the tissues to provide the prolonged treatment necessary. Although the powder method is usually considered to be more convenient the effectiveness varies considerably with the species to be rooted. In experiments on a number of citrus species and varieties Cooper (2) obtained much better results with solutions than with dusts. In this connection, it should be pointed out that although cuttings of citrus varieties can be rooted by use of hormones, there is as yet very little evidence regarding the grove performance of these resultant trees compared, for example, with trees on sour or rough lemon roots.

So much work on the use of the growth-substances in the rooting of cuttings has appeared in the literature and this particular practical application is so well known that it seems unnecessary to dwell on it further. It should be emphasized, however, that the use of root stimulating chemicals is an aid to, and not a substitute for, the usual care and precautions necessary for successful propagation.

Another horticultural application arising from the observed root initiating properties of the growth-substances is in the transplanting of certain trees which are slow or uncertain to reestablish themselves due to their lack of ability to quickly develop new feeding roots. Romberg and Smith (9) report that pecan trees dug from the nursery for replanting to the orchard made a much greater growth of new roots in the first season if the old root stubs were treated with indole butyric acid prior to resetting. Their method of treatment, in order to provide that prolonged exposure to growth substance necessary for root initiation, was to

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impregnate toothpicks with indole butyric acid and insert them in the root stubs near the cut ends. This method or some modification thereof is applicable to those trees, like pecans, which have few fibrous roots close to their main axis and which therefore lose the greater part of their feeding roots in the process of digging.

Prevention of Abscission

It is a common observation that if leaves of most plants are severely injured dropping of the leaves soon ensues. This abscission at the base of the peticles also occurs if the leaf blade is removed. La Rue (8) discovered the interesting fact that if the leaf blades of certain plants such as the Begonia were cut off and growth substances dissolved in a lanolin paste were applied to the cut stubs of the petioles these petioles remained green and firmly attached to the plant much longer than similar petioles to which lanolin only had been applied.

This prevention of abscission, brought about by growth substances, is perhaps the most important of all the observed hormone responses from the standpoint of application to horticulture because there are so many problems confronting the grower involving the untimely abscission of leaves, buds, flowers, and fruit. The so-called physiological leaf drop of tomatoes and roses, bud drop of gardenias and sweet peas, flower drop of many plants with little or no fruit setting, and fruit drop which has long been the despair of growers of various fruits, are all familiar instances of premature abscission. Although it is too much to expect that all abscission problems will yield to hormone application, yet notable progress has been made and is continuing to be made in the practical control of drop losses in various crops.

Perhaps the most successful and widely used hormone treatment for delaying abscission has been in the control of the pre-harvest drop of apples (3). To prevent this drop, which in many cases occurs just prior to the development of proper color necessary for top grade fruit, the grower can spray his orchard with a very dilute solution (5 to 10 parts per million) of napthalene acetic acid or napthalene acetamide just as drop first begins. With apples the spray takes effect within a day or two and lasts for several weeks depending somewhat on the variety. Attempting, during the past season, to extend this control measure to the drop of Pineapple oranges the writer encountered only partial control but also some promise of greater success in future trials.

On the basis of the work with apples in which the best results are obtained by delaying the spray application until needed, the first sprays on Pineapple oranges were not applied until November 27. Thereafter at intervales of 3 weeks successive rows of trees in the same grove were given spray applications until February 5 when the last application was made, two weeks prior to picking*. The trees used in this experiment were 8 years old, on rough lemon roots, and were carrying a rather full crop averaging 4.4 boxes per tree. Part of the data secured in this test is summarized in table 1. Although, perversely enough, the drop over the entire grove was usually light, the results showed that the first application of the strong concentration on November 27 resulted in a reduction in drop compared with the unsprayed control row of trees. The difference in drop between the checks and the weaker concentration is not statistically significant. An application

(Continued on page 11)

*Acknowledgement is gratefully made to Mr. Frank Chase of Chase & Co., Winderemere, Florida, for his help and cooperation in the application of these sprays.

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THE PRESENT STATUS OF SCALE INSECTS INFESTING CITRUS

(Continued from page 5)

condition during the two periods are crop yields which are indications of tree vigor. In Figure 1 are recorded annual yields for a 12-year period of a block of 56 pineapple orange trees on the Citrus Experiment Station property; in the season of 1934-35 (season following the freeze) there was a reduction in the yield and a still further reduction in the yield in the season of 1935-36 which, under normal conditions at that time, should have been larger because of the small crop in the 1934-35 season. During the 1938-39 and 1939-40 seasons there was a substantial increase in production, yet the largest crop ever produced in that block was made during the 1940-41 season, following the freeze of January, 1940. It is interesting to note that during 1937 the practice of using the secondary elements was started in this block of trees. Prior to 1938 the trees in this block were in poor condition after each crop and purple scale control was not a problem. An oil spray had never been necessary until 1938, but as the general condition of the trees began to improve purple scales became more abundant. The condition of this grove is typical of the average grove where the more complete program of fertilizing and spraying is used.

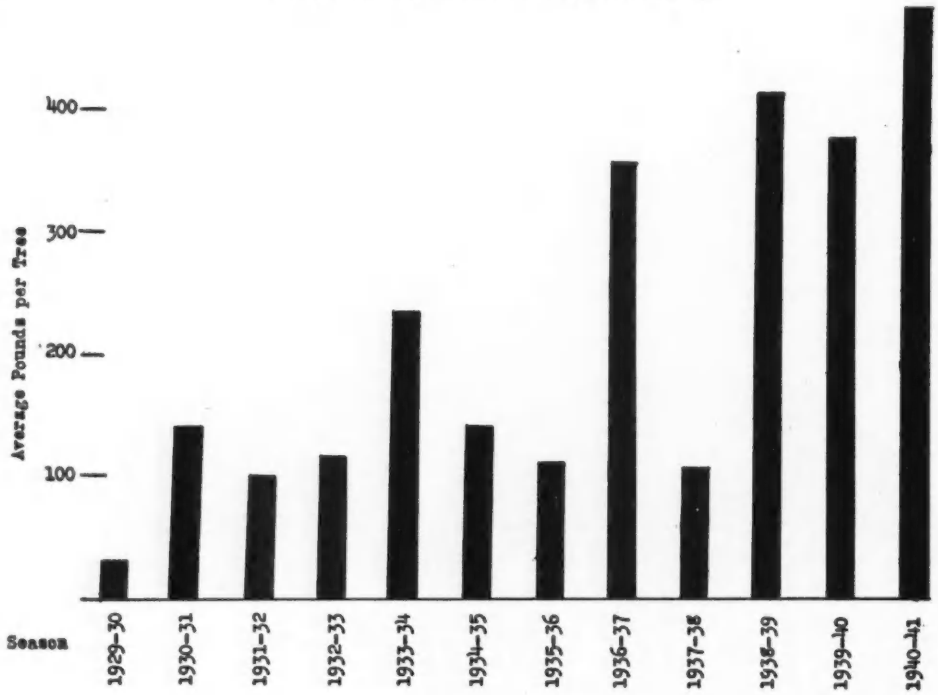
Some Reasons for the Increase of Purple Scale

There is a positive correlation between the percentage of green leaves and the abundance of purple scales. Where magnesium and zinc deficiencies have been corrected there is a high percentage of green leaves throughout the year and the purple scale population is more dense on these trees than where the deficiencies still exist. To demonstrate this fact population counts of purple scales have been made from four different fertilizer experiments at the Citrus Experiment Station where magnesium deficiency still exists in some plots and has been corrected in others and without exception there has been a heavier infestation on the trees where the magnesium deficiency has been corrected. To further demonstrate the correlation of the percentage of green leaves to the degree of scale infestation, each sample of leaves collected at random for the scale counts was classified under green leaves and bronzed leaves. A leaf was considered bronzed if there was a definite magnesium deficiency pattern. These leaves were collected from trees that had received magnesium in various amounts. One group of trees received magnesium in the form of dolomitic limestone and another received it in the form of magnesium sulfate. The percentage of green leaves and the average number of living scales per leaf are recorded in Figure 2. In each set of plots the percentage of green leaves varied in direct proportion with the amount of magnesium used, and the purple scale population was more or less in proportion to the percentage of green leaves. The scales increased in about the same proportion where magnesium sulfate was used as where dolomitic limestone was used. Because of the dusty nature of dolomitic limestone the purple scale increases have sometimes been attributed entirely to the limestone dust that settled on the leaves when the material was applied just as dust from a highway settles on the leaves and results in heavy increases of scales. The limestone residue may be a contributing factor just as the nutritional sprays are, but the results of repeated population counts of purple scales from trees grown under various cultural practices indicate that the vigor of the trees is more of a factor than the residue on the leaves.

There is a more dense population

Figure 1.

Average Yield per Tree of Pineapple Oranges.



Note: Average pounds per tree computed from yield of 56 trees.

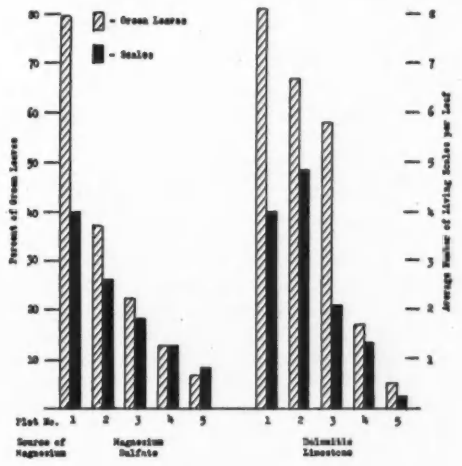
of purple scales on green leaves than on bronzed leaves: therefore, trees with a high percentage of green leaves will have more scales than trees with bronzed leaves. This fact has been stated in previous publications (2)(3), but it is well demonstrated in a recent scale count made from plots in a grapefruit block where magnesium had been omitted from the fertilizer formula in one plot and added to the formula in another plot in sufficient quantity to effect partial correction, thus preing the development of a high percentage of bronzed leaves; otherwise the treatment of both plots was identical. In each plot there were three seedy varieties and one seedless variety of grapefruit. Separate leaf samples were collected at random from each of two seedy varieties and from the seedless variety. After the leaves were collected they were classified as in the former experiment, i. e., as green leaves and bronzed leaves. Scale counts were then made from each classification of leaves. The percentage of green leaves and bronzed leaves and the average number of living scales per leaf are recorded in Figure 3. In Plot 2 where magnesium was deficient there was a lower percentage of green leaves than bronzed leaves on each variety, but there was a higher number of living scales per leaf on green leaves than bronzed leaves. In Plot 11 where magnesium has been supplied for three years there was a higher percentage of green leaves than bronzed leaves and, as in Plot 2, there were more living scales per leaf on the green leaves than on the bronzed leaves. In Plot 11 the scale population was more dense on both green and bronzed leaves than in Plot 2 which indicates that the relative abundance of scales is due more to improved tree condition than anything else.

Another probable reason for the noticeable increase of purple scales since the secondary elements have come into use is the increase in the size of the trees and in the density of the foliage. Purple scales thrive under shaded conditions (3) and such conditions now exist in the average grove where the trees are in good condition. In the experiment discussed in the preceding paragraph the grapefruit trees of the seedy variety were not so large as those of the seedless variety, and as recorded in Figure 3 the scales were more abun-

(Continued on page 16)

Figure 2.

Correlation of Purple Scale Infestations to Percentage of Green Leaves.


- Green Leaves
- Scales
Percent of Green Leaves
Average Number of Living Scales per Leaf
Plot No. 1 2 3 4 5 1 2 3 4 5
Source of Magnesium
Magnesium Sulfate
Dolomitic Limestone

In each series of plots, starting with Plot 1, the amount of material was decreased in each succeeding plot.

Note: Comparisons between magnesium sulfate and dolomite as nutrients should not be made from these results because of factors not discussed in this article.

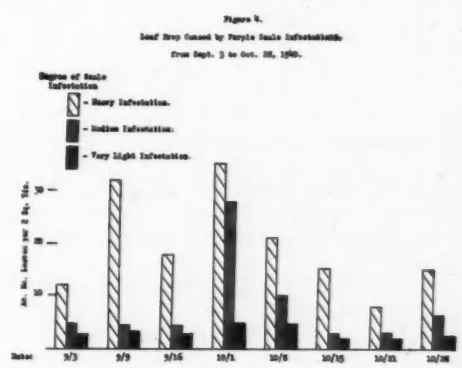
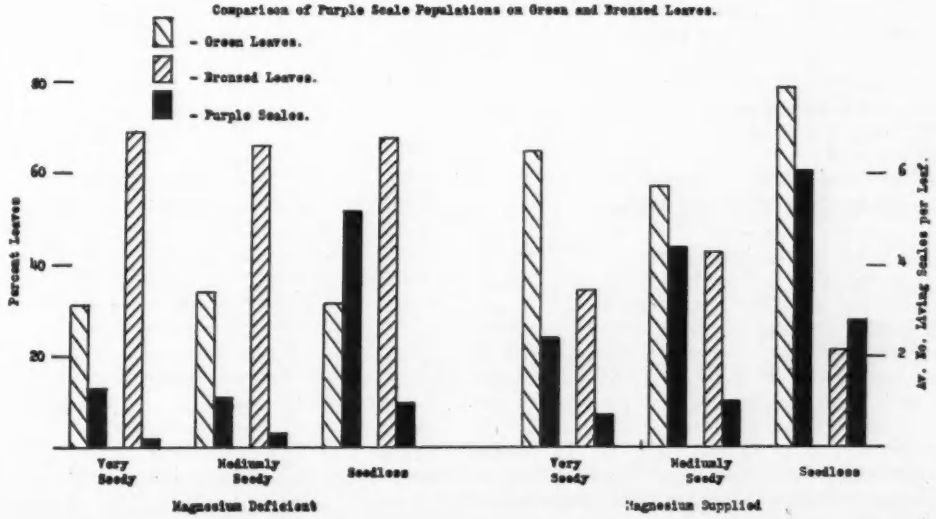

Degree of Scale Infestation
- Heavy Infestation.
- Medium Infestation.
- Very Light Infestation.
9/3 9/9 9/16 10/1 10/8 10/15 10/22 10/28

Figure 3.

Comparison of Purple Scale Populations on Green and Bronzed Leaves.



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LEGISLATURE ACTS ON CITRUS

At the time this is written, the Florida legislature now in session has acted upon a number of bills affecting the processing and sale of citrus fruits. In the main the bills passed by both houses of the legislature have been aimed at strengthening laws already in effect.

Greater restrictions are placed around the coloring of citrus fruits; sales of damaged or immature fruit for canning purposes are prohibited; a research department for the Florida Citrus Commission is authorized; the set-up of the Commission is revised, and in general the powers of the Commission are enlarged.

The proposal of a group of Lake county growers to reduce the advertising tax to a flat one-cent per box on all varieties of citrus; a proposal of Volusia county growers to abolish the Citrus Commission, and another proposal by a group of Hillsborough county growers to repeal all laws governing the shipment of bulk fruit and permitting the shipment of such fruit without regard to inspection, grade or pack, were killed in committee or withdrawn by the sponsors.

A number of bills are still before the legislature, either still under consideration by the committees, or having been reported by the committees still remain unacted upon by the senate or house or both.

In the main, the bills supported by the Florida Citrus Producers Trade Association, the United Growers and Shippers, and the Florida Canners Association were given legislative approval, while those sponsored by local groups of growers were killed in committee. As a result of legislative action, greater strength is given existing laws.

PLACING THE BLAME

The following from the Mission Times, a newspaper published in the heart of the Texas citrus producing section and which takes an active interest in Texas citriculture, should be of interest to growers in every citrus producing section, including Florida. Possibly the comments of the Texas editor might profitably be applied to other citrus regions:

"Returning from a recent trip to Jacksonville, Florida, this writer has gained a better insight into the reasons why the Valley has been having difficulty in securing prices for its citrus fruits. On our return trip we stopped in large food markets in Mississippi, Louisiana and in North Texas, and what we saw made us ashamed to acknowledge that we were from the Valley.

"In each of the large food stores we entered both Texas oranges and grapefruit were on display as were also California oranges. In comparison with California fruit the Texas fruit could not have looked worse had it been potatoes or turnips. How so much cull fruit could have been accumulated in any one store is beyond our ken. It was dirty looking, scarred, and spotted. In comparison with the beautiful textured California oranges Texas fruit could have created in the mind of the shopper no other feeling than that of thorough disgust.

"It would be difficult indeed to convince the people of Texas and adjoining states that the Valley produces quality citrus fruits, because apparently they have never been privileged to see or buy any. We understand in the North and East, where fruit is shipped in carload lots, people know and appreciate Texas quality oranges and grapefruit.

"We people in the Valley complain about the marketing conditions and the low returns from our fruit. We fail to realize that we are our own worst enemies, and that most of the ills that beset us originate right here in the Valley.

"It is the fault of Valley people that we should allow some 200 or 300 quotations to be made each week on Texas citrus fruits. It is our fault that we are allowing third grade and cull fruit to be shipped from the Valley and placed on the market to demoralize the price of our good fruit. It is our fault that our fruit shipments are wholly unregulated. It is our fault that the trucker has peddled third grade fruit into every market in Texas and adjoining states.

"The conditions that affect the marketing of our fruits are almost wholly in our hands. Let's not complain about the competition of California and Florida and of the price-depressing tactics of the buyers. When we get our own house in order many of these conditions over which we have no control will take care of themselves."

TOO MANY "GROUPS"

Reconciling the differences between the interventionists and the isolationists is an easy job compared to reconciling the differences between the various "groups" of citrus growers. And, by comparison, reconciling the differences between capital and labor is mere child's play. —The Polk County Democrat.

Brother, do you mean the grower groups that grow the citrus, or the groups that don't? — Winter Haven Chief.

Almost any "group" which calls itself a "group" of citrus growers. Even among bona fide "groups" of citrus growers, there are "groups," fighting among themselves and against the parent "group," to the great detriment of the industry.

PRACTICAL APPLICATIONS OF PLANT GROWTH-SUBSTANCES IN HORTICULTURE

(Continued from page 7)

three weeks later of a fairly strong hormone concentration also showed effect on drop but the still later sprays on February 5 were entirely without effect. During picking the tightness of the fruit on the first sprayed trees was very noticeable. The evidence indicates that sprays applied very much earlier than November may give worthwhile protection. In contrast, the effect of the sprays on apples so far in advance of maturity is lost by picking time. Like many of the hormone responses this seeming difference in behavior on different fruits is unpredictable and without explanation. During the coming season the effect of time of application on citrus will be studied further.

Parthenocarpy

The development of fruit without the stimulus of fertilization of the ovule is not uncommon. Familiar examples of normally occurring parthenocarpic fruits are the banana, the Thompson seedless grape, and the navel orange. With some fruits the stimulus provided by pollination, even though fertilization does not ensue, is sufficient to cause fruit development. It was this observation, that pollen will in some cases stimulate fruit setting even when fertilization can not take, which led to the discovery that the growth substances can be used to cause fruit development in a number of plants. It was found that pollen contains naturally occurring growth-substances and that extracts of certain pollens can induce parthenocarpy.

The early investigations of Gustafson (5) on hormone-induced parthenocarpy in horticultural crops resulted in fruits such as seedless tomatoes, egg plants, peppers, etc., which were, for the most part, of scientific interest only—chiefly because the methods of application of the hormones, that is by daubing lanolin mixtures of hormones on the flower pistils or injecting hormone solutions into the ovaries, did not lend themselves to practical application. More recently improved methods of application, whereby spraying on of the hormones in an emulsion form can be employed, have greatly enhanced the number of possibilities in which these compounds can be used in a practical way to secure seedless fruits and to improve fruit set (7). It should be mentioned that spraying experiments

(Continued on page 14)

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PRACTICAL APPLICATIONS OF PLANT GROWTH-SUBSTANCES IN HORTICULTURE

(Continued from page 11)

on oranges and grapefruit to improve fruit set have not as yet been very successful, although the possibilities as to methods of application and of more potent compounds have by no means been exhausted.

As might be expected, the different plant species vary greatly in the ease with which they respond to any hormone application. This is particularly true in regard to fruit setting. All attempts thus far to induce the self sterile varieties of apples to set fruit by hormone application have failed entirely. Holly species, on the other hand, will set fruit very readily if the open blossoms are sprayed with a dilute solution of growth-substance (4). It is well known that the hollies are dioecious and that, except for the few species which are normally parthenocarpic, they will not set fruit unless both male and female plants are present. In the event that no male plants are in the vicinity from which insects can carry pollen for fertilization of the female a full set of berries can nevertheless be obtained by application during the blooming period of a spray containing 20 to 50 parts per million of naphthalene acetic acid or naphthalene acetamide. Of the various compounds tried these two have proved most effective for this purpose.

Bud Inhibition

It was mentioned earlier that it is not a consistent characteristic of the growth-substances to stimulate growth for it has been observed that in certain instances growth is sometimes inhibited by these compounds. This is frequently true of strong concentrations on the development of buds or shoots. It is a familiar observation that when the terminal bud or growing point is destroyed, or is removed by cutting back the shoot, it is usually replaced in leadership by the bud or buds immediately below which then start growth. If, however, when the terminal bud is removed, a lanolin paste containing a growth substance is applied on the cut end, the buds immediately below can be inhibited in their development. Presumably in nature the terminal bud releases a naturally occurring growth-substance which moves basipetally and which checks development of buds below it.

The ability of the hormones to check bud development has found several interesting horticultural applications. One of these is in the delaying of fruit tree blossoming in the spring thereby lessening the danger of frost injury to the flowers. Winklepleck and McClintock (13) have reported that peach trees sprayed just prior to bud opening with a strong hormone solution were delayed about 10 days in their blossoming time. During the past season the writer applied sprays of naphthalene acetic acid and naphthalene acetamide in concentrations as high

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as .01 per cent to orange and grapefruit trees at various dates prior to start of the spring flush but there was no evidence of any delay in starting time resulting from these sprays.

Another application of the bud-inhibiting properties of the growth-substance is in the prevention of sprouting of potato tubers during their storage period. Guthrie (6) accomplished this result by spraying the tubers with hormone solution or, in the case of the more volatile compounds, by exposing them to the vapors of the chemical by placing them in impregnated paper bags.

Bending Effects

The very earliest researches concerning plant hormones, long before definite compounds were isolated from plant tissue, dealt with curvature of stems. When hormones are applied unilaterally to growing stems or leaf peticles a greater rate of growth may be obtained on the side of application than on the opposite untreated side, thereby causing a curvature in growth away from the side of treatment. This response has been applied in the training of young fruit tree when first set in the orchard. Verner reports (12) that in heading back yearling apple trees to the desired height the narrow angles which the resulting lateral scaffold branches make with the trunk in many varieties, and which make for structurally weak crotches, can be avoided by treating the pruning cut at the top of the whip with indole butyric acid. Presumably the growth substance, moving downward through the main stem, reaches the upper side of the newly developing lateral shoots causing them to grow more rapidly on the upper side and thus widen their angle with the trunk.

Obscure Effects

In addition to the more readily observable effects of the growth-substances mentioned above there are most certainly many other more obscure, though probably quite as important, effects which will find horticultural application. Brief mention should be made of a possible systemic effect from which plants have purportedly been stimulated to more vigorous growth through seed treatment and by application to the soil. This stimulation has by no means been consistent, undoubtedly making itself evident in certain instances but in the majority of experiments failing to materialize. Some of the reported cases of more vigorous growth from hormone treatment, especially where transplanting is involved, can be attributed to the well known effect of increased root initiation. In other cases there appears to be a direct effect as though a deficiency of some essential compound were being supplied.

(Conclusion of this article, including Tables 1, 2 and 3, will appear in the July number.)

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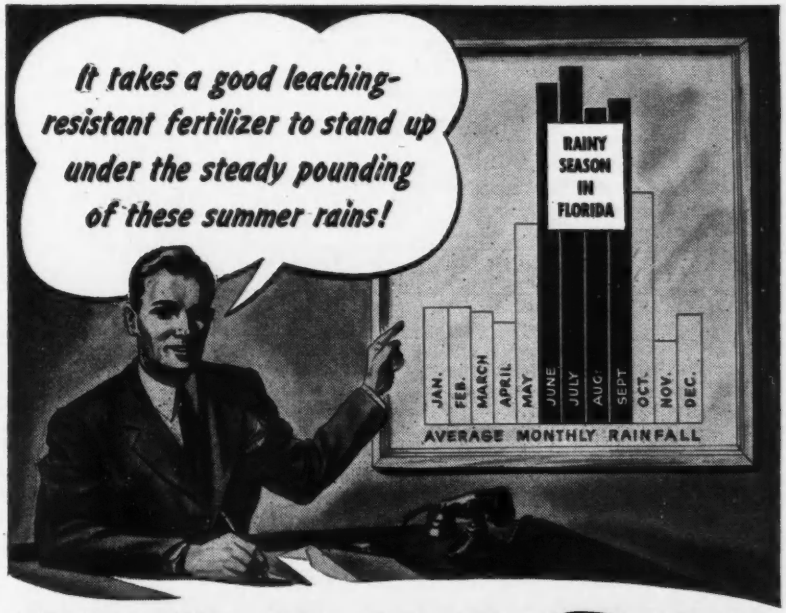

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THE PRESENT STATUS OF SCALE INSECTS INFESTING CITRUS

(Continued from page 9)

dant on the seedless variety than on the seedy varieties. The trees marked very seedy were smaller than those marked mediumly seedy and on an average there were fewer scales per leaf on those trees than on the mediumly seedy variety even though the percentage of green leaves was about the same on both varieties.

Lack of thorough coverage with oil sprays is another reason for reinfestation of scales. The increase of foliage has made it more difficult to obtain a thorough coverage, and lack of coverage has been one of the faults of the Florida citrus grower.

Injury Caused by Purple Scale Infestations

Because purple scales are becoming more abundant it is necessary to study the injury that they may cause. There are several lessons to be learned from the 1940 infestations. First, an apparently light infestation can develop into a very severe one during a single season if conditions are favorable. In several plots where the oil spray was not applied during the early summer the average number of scales per leaf increased from less than one scale per leaf in March to over 75 scales per leaf in September, representing an increase of over 8000 percent. Second, even though the trees may lose from 50 to 75 percent of their leaves due to cold weather, there may be sufficient scales remaining on the limbs and twigs to severely reinfest the leaves by fall. Third, it is more economical and the likelihood of damage is less if the oil spray is applied in the summer than if it is delayed until the fall and winter months. The third point is especially important. Where the oil sprays were delayed until fall the scale populations had built up to such a degree that a severe leaf and fruit drop occurred, and this was a direct loss in addition to the loss of wood and the cost of pruning. Aside from the loss of wood there was a very definite weakening effect on the trees due to the scale infestations. This spring the difference in tree vigor was most outstanding, particularly where the scales were not controlled until November at which time the trees were heavily infested. The trees sprayed in June started to grow three weeks sooner this spring and have a heavier bloom than those sprayed in November.

In order to determine more definitely the extent of injury caused by scales, some records were taken from a block of Pineapple oranges where both fertilizer applications and nutritional sprays have been uniform, the only variation being in the insecticidal sprays. The block was divided into seven plots; two plots were sprayed with oil in June and five plots in November. In the spring of 1940 there was a light infestation of scales in all plots. In the five plots a heavy infestation of purple scales was the primary cause of a severe leaf and fruit drop, the injury being more or less in proportion to the density of the scale population. Between September and November there were six times as many dropped leaves collected in an area of two square yards under each of 16 trees having an average of 26 living scales per leaf as from adjacent trees having .8 scales per leaf. The trees with .8 scales per leaf had been sprayed with oil in June and those with 26 scales per leaf had received no oil spray (see Figure 4). Heavy leaf drop and wood injury are quite often attributed to an oil spray, but scales are more often the primary cause. On November 14 the five plots with rather heavy infestations of scales and one plot with a light infestation were sprayed with 1¼ per cent oil, and on the nights of November 16 and 17 the freezing weather occurred. Following the spray and the cold weather there was a very severe leaf drop from trees heavily infested with scales, but on lightly infested trees there was very little more leaf drop than from lightly infested trees in the unsprayed check plot. The fruit drop was also extremely severe from the heavily infested trees (see Figure 5 for record of leaf and fruit drop before and after oil sprays). There is no doubt that the oil spray was a factor in causing the leaf and fruit drop, but the primary cause was the weakened condition of the trees due to scales. From these records and other published (4) and unpublished work as well as field observations, the evidence is rather conclusive that scale infestations are much more of a factor in causing leaf and fruit drop and deadwood than an oil spray applied with discretion, especially if the spray is applied in the summer before the infestation becomes severe and when there is plenty of moisture in the soil.

Following a heavy infestation of

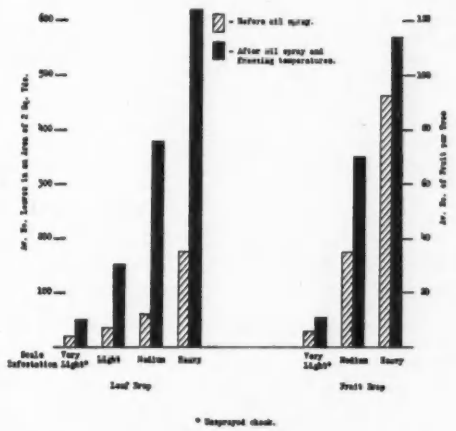
Table 1
Influence of Scale Infestations and Spray Materials in Causing Dead Wood.

Plot	Spray Program		Av. No. Living Scales per Leaf and Av. No. lbs. of Dead Wood per Tree					
			Season 1938-39		Season 1939-40		Season 1940-41	
	Oil Sprays	Sulfur Sprays	Scales	Dead Wood	Scales	Dead Wood	Scales	Dead Wood
1	Wettable Sulfur (4 Applications)	Sept. 3, 1938 Nov. 14, 1940	4.0	9.5	.6	3.7	26.6	18.1
2	Lime-Sulfur (4 Applications)	Sept. 3, 1938 Nov. 14, 1940	12.4	9.1	2.5	5.8	16.7	6.4
3	Lime-Sulfur plus Wettable Sulfur (3 Applications)	Each year in June 1935 to 1940	2.4	7.5	.2	10.6	.8	1.4
4	Lime-Sulfur (4 Applications)	Sept. 3, 1938 Mar. 11, 1940 Nov. 14, 1940	No record	No record	No record	10.1	No record	2.2

Notes: Experiment was conducted from 1935 to spring of 1941.
In Plots 1, 2, and 4 oil sprays were applied only when medium to heavy scale infestations developed.
Plot 3 received an oil spray each year regardless of scale infestation.
Nutritional Sprays: 1937 - Zinc-Lime - 3-1½-100.
1940 - Copper-Zinc-Manganese-Lime - 3-3-3-3-100.

scales the cost of pruning is usually a big item. A three-year record of the weight of pruned wood from several plots is shown in Table 1. In February, 1941, the weight of the dead wood pruned from trees heavily infested with scales last fall was eight times as much as the weight of wood pruned from adjacent trees sprayed in June. The amount of dead wood was in proportion to the scale infestation just as were the leaf drop and fruit drop. Following the freeze of January, 1940, more dead wood was pruned from the oil sprayed trees than from trees that had not received an oil spray in 1939, indicating that there was some weakening effect from the oil. Nevertheless, the amount of wood lost did not affect the 1940-41 crop to any extent because the trees produced the largest crop since they had come into production. Since 1935 those trees have been sprayed annually with an oil spray and at the end of the six-year period they were larger and more vigorous than the trees that were allowed to become infested before an oil spray was applied in 1938 and 1940. In general there has been more wood killed from the effect of purple scale infestations than from oil sprays in the experimental plots as well as in the average commercial grove.

Figure 5.



* Unsprayed check.

Oil sprays are not foolproof and should not be used without some consideration of the condition of the trees. In Forida the most apparent causes of injury from oil sprays have been from sprays applied in the late summer and fall months on trees that had a heavy scale infestation and a crop of maturing fruit; application of a relatively low-grade oil emulsion at a concentration above 1½ per cent actual oil; sepraation of the oil emulsion in the spray tank which results in non-uniform control and severe wood injury on trees sprayed with the last 50 gallons or more of material from each tank; and the application of an oil spray on trees in a semi-wilted or wilted condition.

Present Status of Scale Insects

In all probability more groves were sprayed with oil for scale control during the summer, fall, and winter months of 1940 and the first two months of this year than during any other similar period in the history of the citrus industry in this state. Despite this fact, there is a considerable carry-over of purple scales as well as Florida red scales and at the present they are more evident than they were at this time last year. Where the complete fertility and spray programs are practiced, an oil spray should be applied this summer even though the grove was sprayed as late as January or February of this year. Most of the groves sprayed during the winter were heavily infested at that time and it is seldom that one oil spray will clean up such an infestation to the extent that another spray is unnecessary for 16 to 19 months, which is the approximate iterim between the past winter months and the summer of 1942.

It is quite possible that scale insects will not increase so rapidly this year as last year but a period of 16 to 19 months is too long to expect satisfactory control from one oil spray in groves that were heavily infested when sprayed. Young purple and Florida red scales are already infesting the spring growth. This condition is probably a result of the abundance of residue in the form of sooty mold and dust on the young foliage in some groves. Citrus aphids were not particularly noticeable on large trees but they were sufficiently abundant to deposit an appreciable amount of "honeydew" on the leaves, creating a medium for the growth of sooty mold as well as making the leaves sufficiently sticky to catch dust and fertilizer as it was applied. There may be little evidence of scales by June because of the preponderance of the spring flush of growth, which will hide the old infested leaves and twigs, and the residue on the leaves so for good insurance against a heavy infestation of scales next fall and winter a thorough oil spray should be applied this summer.

NEW CIRCULAR TELLS ABOUT FOOD RESEARCH WITH CITRUS PRODUCTS

What chemical research has done in bringing out new products of citrus is the theme of a new circular, "Citrus Fruit Products," written by two outstanding scientists and published by the U. S. Department of Agriculture. Announcement of the new circular has been received from Washington by the State Agricultural Extension Service.

Authors of the circular are H. W. von Loesecke, chemist with the U. S. D. A. citrus laboratory in Winter Haven, and E. M. Chace, chemist with the Los Angeles, California, U. S. D. A. laboratory.

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Horticultural Hints

There are many views regarding the proper care of grove property, but basically when adequate amounts of a well balanced fertilizer containing a complete range of all plant foods is added to the soil in such a way that the tree can obtain the greatest percentage of this food, and when your spray program includes the materials that will control the ravages of insects and diseases, and coupled with this a program of cultivation that will keep the soil in a productive state, then it is our idea that you are giving the grove proper care.

Growers in all sections of the state have been busy during the past month with their summer application of fertilizer. It is very encouraging this summer to talk with growers and find that without exception they are interested in having the best crop of fruit ever produced on their property this fall.

We believe that this dream of better fruit will come true this fall and we are not guessing about the matter but speaking from what we have seen during the past month. The customers of this Company are doing their part in the better fruit program as is definitely shown in the type of fertilizer that they have been using this summer.

It is safe to state that 95 percent of the growers doing business with the Lyons Fertilizer Company are using the mixtures that contain a complete range of all the necessary plant foods. Scientific and practical experiments have definitely shown that this is one of the essentials in the production of larger quantities of quality fruit.

We are going on record here as a strong advocate for the use of high quality fertilizer for high quality fruit, and we urge those growers that have not yet made their summer application of fertilizer to contact one of the Lyons Field Men and consult with him about the most economical (determined by the net profit at the end of the season) methods of citrus production.

Remove all dead wood and water sprouts from the trees during the summer. Keep your young trees thoroughly cultivated and also watered at the first signs of a drought. Fertilize the young trees at 60 to 90 day intervals. Keep a thorough check on rust mite all during the summer. If your scale is reaching serious proportions, we strongly urge you to spray with oil and do not count on friendly fungi to control this insect.

Reports of Lyons Field Men . . .

POLK & HIGHLANDS COUNTIES
J. M. (Jim) Sample

Unless rain is immediately forthcoming, serious damage is indicated to both trees and fruit in this area. It is already noted that the new fruit crop is dropping excessively, with the heaviest loss being shown by Valencias. Tangerines and early grapefruit are going to be light in this section next year. The present Valencia crop is fast being cleared up and grapefruit is practically gone.

Most of our growers averaged from $1.00 to $1.25 for their Valencias, and those growers who are still holding their crop are anticipating better prices by the first of June.

NORTH CENTRAL FLORIDA
H. C. (Doug) Douglas

Growing conditions have been most favorable throughout this section and groves that have been properly cared for have made fine progress this spring with all varieties of oranges setting a nice crop. Fruit prices in this section have not been as good as we anticipated, but most growers with good quality fruit have been able to market their crop at a profit.

While the vegetable crops have been curtailed as far as acreage is concerned and with smaller crops as a result of weather conditions the price has been good and most of the growers are making some money.

SOUTHWEST FLORIDA
F. W. (Felton) Scott

Growers in the Wauchula section have had a very nice spring season on all of their vegetable crops. Yields have been fair and the price received has been very good. In the Palmetto and Ruskin sections the yield was not so good as a result of weather conditions, but with all commodities bringing a good price the season will end with most growers able to show a profit on the season's operations.

Citrus growers throughout this section are either making their application of fertilizer at this time or are planning to do so during the early part of June.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

The vegetable growers in this territory have just about finished with the harvesting of their spring crops. This has been one of the most disastrous seasons as far as weather conditions are concerned that we have had in many years. In spite of these backsets though, we are glad to report that a number of our customers have been able to show black ink for their season's operations.

Citrus growers in this section are feeling very encouraged over the condition of their grove properties and also about the crop of fruit that they have set.

HILLSBOROUGH AND PINELLAS COUNTIES
C. S. (Charlie) Little

Growers throughout this section have been extremely busy during the past month with the many duties involved in the proper care of their groves. Spraying has been one of the major operations, and I am glad to report that most of the growers in the section are employing a good spray program in an effort to produce real quality fruit this season. One other noticeable feature in connection with the desire of the grower to produce quality fruit this spring is the fact that all growers in this section are using well balanced fertilizer that contains a complete range of the secondary fertilizer elements.

The crop for the coming year will be somewhat smaller than during the past season as a result of the small crop of fruit set by early grapfeuit trees.

It Is The Man Who Takes Proper Care of His Grove So As to Produce Larger Crops of High Quality Fruit Who Makes the Most Out of His Grove.

ADVERTISEMENT — LYONS FERTILIZER COMPANY

Alvin McHargue, Prominent Vegetable Grower Recommends Lyons Fertilizers For All Vegetables

Mr. McHargue, whose picture is reproduced herewith in the midst of his bumper-crop tomato field, was one of the first growers to start tomato production in the Ruskin section.

He is one of the most progressive growers of the section and employs all of the latest up-to-the-minute scientific and practical methods in the production of his crops.

Growers in the Ruskin section state that Mr. McHargue's crop of tomatoes is one of the very finest in that section this year, and the yield and quality are unusually excellent.

Mr. McHargue says that he is extremely well pleased with Lyons Fertilizer and gives our fertilizer a large share of the credit for the exceptionally fine crop of tomatoes he produced this spring. He further adds that he unhesitatingly recommends Lyons Fertilizer for any vegetable crop — whether it be tomatoes, beans, pepper, or any other vegetable crop grown in Florida.

A REVIEW OF OUR KNOWLEDGE OF MELANOSE AND ITS CONTROL

(Continued from page 4)

do an average pruning job and supplement this with a copper spray. Under some conditions it may be advisable to use a second copper spray.

The question of the best time to prune has frequently been discussed. For best melanose control trees should be pruned just prior to the spring growth and bloom. This time for pruning would enable the grower to remove the recently killed dead wood which is the principal source of infection. However, there are many factors which may make it impractical to prune in the early spring. As a general rule, pruning must necessarily be done when labor is available at a reasonable price and other cultural practices do not interfere. There are, of course, exceptions to all rules and in the event trees have been badly damaged by a freeze or other cause the dead wood should be removed as soon as the extent of the damage can be determined.

Dusting

In the early '20s several dusting experiments for melanose control were conducted (7). Copper-lime dust, bordeaux dust and sulphur dust were used. Even where as many as four thorough applications were made no appreciable control of the disease was observed. At the same time single applications of bordeaux-oil gave good control.

The results obtained from the dust materials used at that time were so disappointing that the method does not appear worthy of trial on a large scale. However, new materials may be developed which will give satisfactory control when applied in dust form.

Spraying

In an effort to determine the most satisfactory material or materials to use for controlling the melanose fungus a wide variety of fungicides have been tested. Included among these are several neutral coppers, mercury, sulphur preparations, liquid and dry lime sulphur, bordeaux mixtures and combinations of many of these materials.

Spraying with some form of copper has been found to give the most satisfactory and economical control of melanose. When this spray is supplemented with a reasonably good pruning the control is considerably better than spray alone.

A series of experiments (9) have been conducted to determine the most effective time for applying copper sprays and the number of sprays necessary. The results of these experiments indicate that a dormant spray can be expected to give only fair melanose control, and unless necessary for scab control the expense is not justified. A single post-bloom spray applied two or three weeks after the petals fall gives the most satisfactory results. A second post-bloom spray applied three or four weeks after the first spray may give a slightly higher percentage of control but the difference does not generally justify the expense except under very unusual conditions.

Spray Materials

For several years a standard bordeaux mixture 6-6-100 or this mixture in combination with oil emulsion was used extensively for the control of melanose. These materials gave satisfactory control of the fungus but several disadvantages soon became apparent. It was found that this combination sometimes scorched tender foliage and caused a surface burn or blotch on young fruit. Also, this mixture, particularly when combined with oil, was found to cause star melanose on the leaves and twigs. Scale insects developed rapidly following the use of bordeaux and even where oil emulsion was added it was generally necessary to follow with an aplication of oil emulsion later in the season.

Due to the difficulties experienced with bordeaux mixture a demand was created for other equally effective fungicides. In the past few years several neutral copper preparations have been developed which have at least partially overcome the disadvantages of bordeaux mixture and are rapidly taking its place. These materials cause very little or no burning on tender foliage and leave less residue on the leaves to harbor scale insects. Unfortunately, even these neutral coppers when combined with oil emulsion may cause a surface blotch on young fruit and start melanose on the leaves and twigs. Most growers consider this an unsafe combination.

In order to determine the comparative effectiveness of these num-

TABLE 1

The following figures are taken from the New York Daily Fruit Reporter, and are composed of the averages of the four or five leading shippers on the East Coast. These averages are for INDIAN RIVER fruit sold on the New York Auction ONLY.

	Oranges		
Season 1935-36	U. S. No. 1	U. S. No. 2	Difference
Common	$3.16	$2.71	.45
Pineapple	3.54	3.02	.52
Valencia	3.44	3.11	.33
Season 1936-37			
Common	3.37	3.03	.34
Pineapple	3.46	3.13	.33
Valencia	4.19	3.61	.58
Season 1937-38			
Common	2.51	1.99	.52
Pineapple	3.03	2.38	.65
Valencia	2.44	2.01	.43
Season 1938-39			
Common	2.26	1.90	.36
Pineapple	2.46	2.02	.44
Valencia	2.76	2.31	.45
Season 1939-40			
Common	2.41	2.15	.26
Pineapple	2.53	2.25	.28
Valencia	3.69	3.17	.52

TABLE 2

The following figures are taken from the New York Daily Fruit Reporter, and are composed of the averages of the four or five leading shippers on the East Coast. These averages are for INDIAN RIVER fruit sold on the New York Auction ONLY.

	Grapefruit		
Season 1935-36	U. S. No. 1	U. S. No. 2	Difference
Common	$2.98	$2.46	.52
Marsh Seedless	3.64	2.88	.76
Season 1936-37			
Common	2.29	1.90	.39
Marsh Seedless	2.92	2.48	.44
Season 1937-38			
Common	2.55	2.09	.46
Marsh Seedless	3.22	2.46	.76
Season 1938-39			
Common	2.00	1.62	.38
Marsh Seedless	2.39	1.83	.56
Season 1939-40			
Common	2.46	2.02	.44
Marsh Seedless	2.97	2.54	.43

erous copper materials extensive experiments have been conducted at the Citrus Experiment Station (9). The results of the experiments indicate that when these neutral coppers are used on a comparable metallic copper basis, with a minimum of three-quarters of a pound of metallic copper per 100 gallons, they all give fairly satisfactory results. The experiments further indicate that there is a rather definite correlation between the size of the particles, the percentage of metallic copper and the control that can be expected. In other words, the smaller the particles and the higher the percentage of metallic copper, the better the control. Whether this is due to the percentage of copper, the size of the particles or the adhesiveness of the materials has not been determined.

In view of the fact that experimental evidence indicates that a little higher percentage of metallic copper in the spray is reflected in better melanose control, I would suggest a dosage varying from three quarters of a pound to one pound of metallic copper per 100 gallons depending upon the probable severity of the infection based on tree condition and weather.

It has become a general practice to include wettable sulphur with melanose sprays to control rust mite and other members of the spider family. This is very desirable, particularly if a sulphur is selected which has good adhesive properties. It is essential to stick both the copper and the sulphur on the tree to get good control of melanose and mites. Both zinc and manganese sulphates, which are often combined with melanose sprays, are excellent stickers.

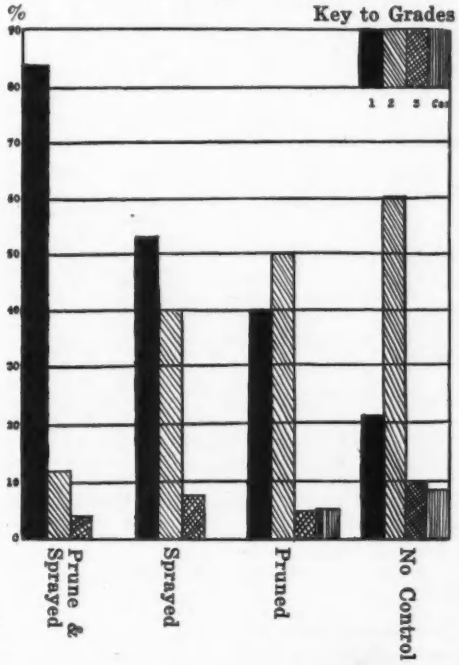
The question frequently arises as to how thoroughly the trees should be sprayed. Experimental evidence indicates that the control of fungi and insects will be in direct proportion to the concentration of the spray, thoroughness of application, percentage of deposit and the length of time that the materials remain on the trees.

Cost of Spraying

Most growers realize that when copper sprays are applied for control of melanose they kill many friendly fungi which are of great value in the natural control of rust mite, six-spotted mite, red spider, aphids and scale insects. Therefore, in figuring the cost of melanose control we must also include the added cost of insect control. Whenever copper sprays are used I would strongly recommend that they be followed with an oil spray for scale control. Frequently growers skip this oil spray because the scale infestation does not seem heavy enough to justify the expense of spraying. In nearly every case such a practice results in a heavy scale infestation in the fall with the subsequent loss of bearing wood and expense of pruning.

Chart 1

Percentage Fruit Grades as Affected By Pruning and Spraying for Melanose Control



In order to arrive at the approximate cost of a complete spray program and the return which may be expected from such a program I have prepared some figures based upon the current cost of materials and the conventional method of spraying. In view of the fact that there is a reasonable correlation between the number of boxes of fruit a tree will produce and the number of gallons of spray required I have arbitrarily selected orange trees capable of producing an average of four boxes of fruit and requiring approximately ten gallons of spray per tree per application to use as an example.

The cost of spraying and dusting will vary according to equipment, nearness to water, etc., but on the average I believe it is ample to allow ½c per gallon for applying sprays and ½c per pound for dusts. Using one copper spray, containing 1.04 lbs. of metallic copper, 10 lbs. of wettable sulphur and 1 pint of sticker per 100 gallons; one oil spray, with 1½% actual oil; two dustings with 1 pound of dust per tree per application and one lime sulphur spray at a dilution of 1 to 50 plus 5 lbs. of wettable sulphur per 100 gallons the total cost per tree would be 34.4c or 8.6c per box. Trees of the size discussed could be pruned commercially for about 20c per tree or a cost of 5c per box. This would make the total cost of the pruning and spraying program 13.6c per box.

In 1939 Mr. H. A. Thullberry of Haines City gave a paper before the Horticultural Society in which he reported on a commercial melanose control experiment which included spraying and pruning and a combination of both. I have reproduced the data of Mr. Thullberry's experiment in graphic form in chart 1. This shows very clearly the improvement in grade which can be obtained by pruning and spraying. Those blocks which were pruned and sprayed produced 63% more U. S. No. 1 fruit than the check blocks.

Referring again to our example, if we had 75 orange trees per acre the production would be 300 boxes. This is a good yield but entirely possible. If, by pruning and spraying, we could increase the No. 1s 63% over similar blocks not pruned or sprayed it would mean 189 more boxes of No. 1 fruit per acre. From the data in Table 1 we find that over a period of 5 years we can expect to receive approximately 40c per box more for No. 1s than for No. 2s. On this same basis we would receive $75.60 more for the fruit from the sprayed and pruned block than from

the check block. However, all the fruit was sprayed and all the trees pruned in the control blocks making a total cost of spraying and pruning $40.80 per acre. This would leave a net profit from the spraying and pruning of $34.80 or an 85% return on the investment.

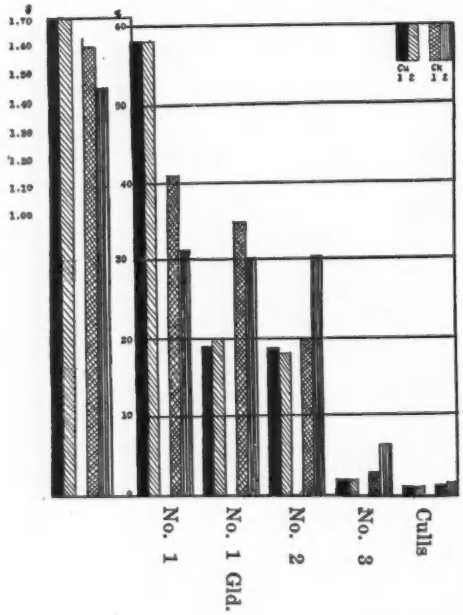
In order to determine the value of copper sprays for melanose control in groves belonging to the Deerfield Groves Company we have conducted careful experiments on our Sunset Grove located on Merritt Island. It has been our practice to spray four rows with copper and sulphur and the adjoining four rows with lime sulphur and wettable sulphur for rust mite control. At picking time this fruit is picked and graded separately so that we have a true picture of the fruit quality based upon regular packing house grades. In our blocks this year the trees were spot picked for color and appearance on December 2nd and cleaned on January 10th. Chart 2 shows the percentage of each grade from the blocks for both pickings and the net returns per field box picked. In the first picking the fruit sprayed with copper returned 11c more per field box than the fruit which was not sprayed with copper. When the trees were cleaned the fruit sprayed with copper returned 26c more per field box than the fruit which was not sprayed with copper. In order to overcome the fluctuations of the market in arriving at these figures the prices are based on the average return for each grade from this grove for the current season.

It so happened that the cost of the spray program on the check blocks was only about ½c per box less than in the copper blocks so that we realized a very substantial profit from the use of the copper. Even if there had been no expense for spraying on the check blocks and the cost of the complete program on the copper blocks was 13.6c per box, with an increased net return of 26c per field box there was a net profit on the spraying and pruning of 12.4c per field box or 91% return on the investment.

Due to the many variable factors, over which the grower has no control, the results of the same spray program will vary greatly from year to year. In old bearing blocks, melanose control is insurance which generally pays good dividends.

Chart 2

Commercial Test of Copper Sprays for Melanose Control on Pineapple Oranges.



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(Concluded on next page)

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Cooperation In Citrus Packing Industry Drive

U. S. Dept. of Labor, Wage and Hour Divison

First report of an industry-wide drive now being conducted among the nation's leading citrus fruit packing plants by the Wage and Hour Division, U. S. Department of Labor, reveals general willingness among citrus operators to comply with provisions of the Fair Labor Standards Act, it was announced by General Philip B. Fleming, Administrator of the Division.

The drive, which follows a six-months' period of self-cleansing in the industry undertaken through cooperation between the industry's associations and the Wage and Hour Division, was begun early in March and will continue until the entire industry has been covered, the Administrator said. Between 45,000 and 50,000 employees are estimated to be employed in the 1100 to 1500 plants in the industry, which is centered principally in the orange, grapefruit, and lemon growing areas of Florida, Texas and California. A much smaller portion of the industry is located in Arizona and in those regions of Louisiana, Mississippi, and Alabama bordering on the Gulf of Mexico.

"Results of the drive to date," General Fleming said, "indicate that the citrus fruit packing industry is generally cooperating with the Wage and Hour Division in an effort to extend the minimum wage and maximum hours provisions of the Fair Labor Standards Act to all covered workers. The type of violations revealed in those plants already inspected indicates only minor instances of non-compliance, and operators are promptly making corrections where pointed out."

An immediate result of the drive of benefit to employees is provided through back wage payments totaling $9,284, to be received by 562 workers.

Results of the drive to date, by areas, follows:

FLORIDA AREA — Total inspections, 66; firms covered, 65; firms in compliance, 15; firms in violation, 50; firms violating minimum wage provision, 21; firms violating maximum hours provision, 24; firms violating other provisions, 30; firms paying restitution, 26; amount of restitution, $4,000; number of employees receiving restitution, 400.

TEXAS AREA — Total inspections, 116; firms covered, 90; firms in compliance, 42; firms in violation, 48; firms violating minimum wage provision, 6; firms violating maximum hours provision, 4; firms violating other provisions, 42; firms paying restitution, 4; amount of restitution, $4,257; number of employees receiving restitution, 77.

CALIFORNIA AREA — Total inspections, 216; firms covered, 182; firms in compliance, 28; firms in violation, 154; firms violating minimum wage provision, 39; firms violating maximum hours provision, 35; firms paying restitution, 56; amount of restitution, $1,027; number of employees receiving restitution, 85.

A REVIEW OF OUR KNOWLEDGE OF MELANOSE AND ITS CONTROL

(Continued from preceding page)

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